ENGINEERING EDUCATION

Bulletin of the

Society for the Promotion of Engineering Education

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Chas. F. Scott, Mortimer E. Cooley, F. L. Bishop, *Editor*.

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TENTATIVE PROGRAM OF THE 31ST ANNUAL MEETING OF THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, CORNELL UNIVERSITY, ITHACA, N. Y., JUNE 20 TO 23, 1923.

Keynote of the Meeting: TRAINING FOR LEADERSHIP.

WEDNESDAY, JUNE 20.

11:00 A.M. Meeting of the Council, Library, Sibley Dome.

12:30 P.M. Luncheon for the Council, Red Room, Prudence Risley Hall.

2:00 P.M. Opening Session, Room B, Goldwin Smith Hall.

Address: Training for Leadership. Dexter S. Kimball, Cornell University.

Board of Investigation and Coördination—Its Function in Training for Leadership. C. F. Scott, Yale University, Chairman.

Discussion by the Members of the Board:

J. H. Dunlap,
M. E. Cooley,
F. W. McNair,
D. C. Jackson.

Coöperation of Engineering Schools with the Board of Investigation and Coördination. J. Raleigh Nelson, Chairman, Coöperating Committee, University of Michigan.

Report of Committee No. 5, Membership. A. A. Potter, Purdue University, Chairman.

Appointment of Committees.

8:00 P.M. Reception tendered by the President and the faculty of Cornell University.

Welcome by Livingston Farrand, President, Cornell University. Prudence Risley Recreation Room.

Response C. F. Scott, President of the Society.

Cornell University, Illustrated, Dean D. S. Kimball.
Reception, Prudence Risley Hall.

THURSDAY, JUNE 21.

9:00 A.M. Meeting of the Council, Library, Sibley Dome.
Preliminary Conference of English Teachers and Those Interested in Problems of English Teaching. J. Raleigh Nelson, University of Michigan, Chairman. Room C, Goldwin Smith Hall.
Conference of Teachers of Drawing. R. S. Kirby, Yale University, Chairman. Room 2, West Sibley Hall.

10:00 A.M. Second Session. Room B, Goldwin Smith Hall.
The Engineer as a Leader in Public Service. T. H. MacDonald, Chief, Bureau of Public Roads, Washington, D. C.
The Engineer as a Leader in Transportation. Daniel Willard, President, Baltimore and Ohio Railroad.
The Engineer as a Leader in Industry. Oliver S. Lyford, representing the National Industrial Conference Board.
Discussion, D. S. Kimball, Cornell University.
Report of Committee No. 15, Civil Engineering. A. H. Blanchard, University of Michigan, Chairman.

2:00 P.M. Third Session, Room B, Goldwin Smith Hall.
The Engineer as a Leader in Business. W. E. Wickenden, Assistant Vice-President, A. T. & T. Co.
Report of Committee No. 14, Business Training. W. E. Wickenden, Chairman.
A Combined Five-Year Course in Engineering and Business Administration. Lionel S. Marks, Harvard University.

3:00 P.M. Open House Inspection Tour.

7:00 P.M. Annual Dinner, Prudence Risley Hall.
Presidential Address: Training for Leadership. C. F. Scott, Professor of Electrical Engineering, Yale University.

FRIDAY, JUNE 22.

9:00 A.M. Meeting of the Institutional Delegates, Room B, Goldwin Smith Hall.

Conference of the Division of Deans and Administrative Officers, W. G. Raymond, Chairman. "What is a Desirable Procedure to Improve the Quality of Teaching in Engineering Colleges?" J. G. Bowman, Chancellor, University of Pittsburgh. Room A, Goldwin Smith Hall.

Second Conference of Teachers of English: "How may the closest possible inter-relationship be established between the instruction in English and that in professional subjects?" Room C, Goldwin Smith Hall.

11:00 A.M. Fourth Session, Room B, Goldwin Smith Hall. Fundamentals in Training for Leadership.

A study of these by Committee No. 17, Electrical Engineering. Report by H. E. Dyche, University of Pittsburgh, Chairman.

Discussion:

F. E. Turneaure, University of Wisconsin.

G. B. Pegram, Columbia University.

F. L. Bishop, University of Pittsburgh.

2:00 P.M. Leadership in Industry. G. O. Frampton, Toledo University.

Analysis of the Attendance at Engineering Schools. W. C. John, U. S. Bureau of Education.

Laboratory Instruction in Engineering. Roy Kegerreis, Mayo Clinic, Rochester, Minn.

Report of Committee No. 8, Admissions. O. J. Ferguson, University of Nebraska, Chairman.

Report of Committee No. 16, Mechanical Engineering. W. T. Magruder, The Ohio State University, Chairman.

Report of Committee No. 18, Mining Engineering.

F. W. Sperr, Michigan College of Mines, Acting Chairman.

Report of Committee No. 21, R. O. T. C., P. F. Walker, University of Kansas, Chairman.

Report of Nominating Committee.

Election of Officers.

6:00 P.M. Dinner Meeting of the Council.

8:00 P.M. Round table smoker, Recreation Room, Prudence Risley Hall.

SATURDAY, JUNE 23.

8:30 A.M. Second Conference, Division of Deans and Administrative Officers. "Shall the Requirements for Graduation from the Standard College Course in Engineering Include the Equivalent of more than Four Years of College Work?" M. E. Cooley, University of Michigan. Library, Sibley Dome.

10:30 A.M. Fifth Session, Room B, Goldwin Smith Hall.

Address: The Teachers Place in Training for Leadership. Ira N. Hollis, President, Worcester Polytechnic Institute.

Report of Committee No. 12, English. J. Raleigh Nelson, Chairman.

Report of Committee No. 19, Drawing. R. S. Kirby, Chairman.

Report of Committee No. 24, Engineering Experiment Stations. C. S. Howe, Case School of Applied Science, Chairman.

Report of Committee No. 25, Licensing Engineers, C. S. Howe, Chairman.

Report of Committee No. 6, Sections and Branches. F. C. Bolton, A. and M. College of Texas, Chairman.

Report of Committee on Resolutions.

Report of the Treasurer.

Report of the Secretary.

REGISTRATION AND INFORMATION.

Take any street car at any station, get off at Goldwin Smith Hall on the Campus. No transfers are necessary except for those arriving at East Ithaca; transfer at College Ave. to Eddy St. car.

Registration and *Headquarters* for the convention will be on the first floor of Goldwin Smith Hall, middle entrance. Members will please register here immediately on their arrival.

Rooms will be assigned in the residential halls of the University and the dining rooms in these buildings will be kept open for regular meals during the convention as other eating places are distant. Rates for room and meals $4.00 per day, and for meals alone $2.50 a day. The rooms will be available through the Sunday following the convention.

Ithaca Hotel. European Plan; single room with bath $4.00 per day; without bath $3.00. Two in a room $3.00 and $2.00 each. American Plan; $7.00 and $6.00 per person in single room; $6.00 and $5.00 each for two in a room.

Clinton House. European Plan only; single room with bath $3.00 up per day; with running water $2.00 up. Double, with bath $5.00.

Automobile routes leading to Ithaca are good and of scenic beauty.

Camping Sites will be available for automobilists who desire them during the convention.

Mail for members may be addressed: S. P. E. E. Headquarters, care of Dean of Engineering, Ithaca, N. Y.

MEETING PLACE.

All meetings of the Society will be held in Goldwin Smith Hall.

All meetings of the Council will be held in the Library in Sibley Dome.

ENTERTAINMENT: *Recreation and Excursions.*

The local committee has arranged a luncheon for the Council following its first meeting. It will be held in the Red Room of Prudence Risley Hall at 12:30 P.M. Wednesday, June 20.

On Wednesday evening, June 20, there will be a reception in Prudence Risley Hall. At 8 P.M. in the Recreation Room in this building, Dr. Livingston Farrand, President of Cornell University, will give an address of welcome and Dean D. S. Kimball will give an illustrated talk on Cornell University. The reception will be held afterward in the parlors and will not call for formal dress.

On Thursday afternoon, June 21, the College of Engineering will hold open house for the members and guests. Other arangements will be made for the visiting ladies who are not interested in engineering matters.

On Thursday Evening, June 21, at 7 P.M., the annual dinner will be held in Prudence Risley Hall. This dinner will be informal. Tickets $1.50 for those boarding in the Residence Halls and $2.50 for others.

On Friday, June 22, at 8 P.M., a Smoker for the men will be held in the Recreation Room, Prudence Risley Hall, and entertainment for the ladies will be given elsewhere.

While the convention is in session the Ladies Committee will provide teas, automobile trips and other entertainments for visiting ladies and children. A program for the ladies will be furnished at the time of registration.

The region surrounding Ithaca is one of great natural beauty and there are many interesting excursions which may be made by automobile or bus. The local committee will furnish information and endeavor to arrange for such trips during the convention and for the Saturday afternoon and Sunday following.

Golfers having their own clubs with them will find good links available. Men and women bringing bathing suits will enjoy the swimming hole in the gorge back of the Engineering College. Tennis courts are available.

Local Committee.

W. N. Barnard, Chairman.

General Committee.

W. N. Barnard, Chairman.

D. S. Kimball, H. S. Jacoby,
F. A. Barnes, P. M. Lincoln, H. Diederichs,
C. L. Walker, J. G. Pertsch, F. O. Ellenwood.

Registration Committee.

J. G. Pertsch, Chairman.

S. S. Garrett, F. G. Switzer, C. Crandall,
R. F. Chamberlain, B. K. Northrop, F. S. Rogers.
K. D. Wood,

Reception Committee.

H. S. Jacoby, Chairman.

D. S. Kimball, E. E. Haskell, F. H. Bosworth,
A. W. Smith, F. Bedell, H. Diederichs,
V. Karapetoff, P. M. Lincoln, H. N. Ogden,
F. A. Barnes, I. P. Church, L. M. Dennis.

Entertainment Committee.

F. O. Ellenwood, Chairman.

W. M. Sawdon, L. C. Urquhart, C. D. Albert,
S. G. George, M. A. Lee, E. H. Wood,
A. C. Davis, R. F. Jones, J. L. Weber,
F. C. Evans.

Open House.

C. L. Walker, Chairman.

C. D. Albert, E. W. Schoder, G. B. Upton,
W. C. Ballard, H. H. Scofield, A. E. Wells.
V. R. Gage, C. E. Townsend,

Ladies' Committee.

Mrs. W. N. Barnard, Chairman.

Mrs. F. A. Barnes. Mrs. S. S. Garrett.
Mrs. R. F. Chamberlain.

TEACHING AND SCHOLARSHIP.*

BY JOHN G. BOWMAN,

Chancellor of the University of Pittsburgh.

The Purposes of the University.—"But to talk about the purposes of the University, neglecting at the same time the means to attain the purposes, is futile. Our business is to know what we want and how to get what we want. Obviously the chief factor in the success of the University is good teaching. Let us consider here, then, two essentials of good teaching: First, scholarship and, second, close contact between the faculties of the University and the citizens of Pittsburgh and Western Pennsylvania.

"*Scholarship.*—Just what happens to students in the classroom and in other contact with teachers is difficult to say. But this much we know: If boys and girls are to find righteousness in the University, they must see and feel righteousness in those about them. Rules, demerits and precepts will never teach the lesson. Righteousness shines through from one life to another. Again, if boys and girls are to gain the power to think and the habit of constructive thought, they must gain this power and this habit not only from their own efforts, but also from the words, actions, and expressions of their instructors from the beginning of each class hour to the end. What the instructor laughs at and does not laugh at are quite as important as what he says. This statement is commonplace, but we forget.

"Great teaching is a process of illumination; it is stuff made of personality, character, scholarship, and professional training in the art of teaching. Much that is taught shines through from the inmost life of the teacher and inspires, enheartens, and grows in the life of the student. If we waken

* Annual Report of the Chancellor, University of Pittsburgh.

in a boy or girl a radiant mark of attainment, the industry and persistence of that boy or girl are usually won. And then if we throw the boy or girl into association with instructors who themselves have set out for the stars, their lives vibrant with righteousness, culture, scholarship, and disciplined thought, we have education at its top-most good. Here the sum of all possible good in teaching seems to be concentrated. It is the intellectual and spiritual.

"But to get to the phase of the teacher's proficiency which needs emphasis here: Success in teaching requires that the teacher have developed in him great sensitiveness, enthusiasm, and hard, matter-of-fact discipline in truth. Let me repeat, hard, matter-of-fact discipline in truth, for upon that is needed the emphasis. Incidentally the living together of these three qualities in a single mind is a rare coincidence, which fact goes far to explain why great teachers are few in number. But the fewness of great teachers is not the point now under consideration. The point is as to the value to the University of teachers who possess that high wisdom or scholarship which springs from training in exact thought; and the danger to the University of teachers who do not possess that quality.

"Solid training alone does not make a teacher. That is obvious. But the lack of solid training defeats a teacher's success. The results are these: First, the teacher untutored in exact thinking finds himself, at middle life or before, the product of confusion and of disappointment and becomes increasingly ineffective. Second, such a teacher, as mental confusion and disappointment grow into habit, becomes a detrimental influence among his colleagues. He gets in the way of the University's forward step. Third, shreds of facts patched together with wayward imagination are unsafe stuff in any classroon. Knowledge of what is and whole vision are a part of the University's pledge to its students. Nothing less will do. . . .

"The principle here is this: The teachers in the University

are a distinct social division of the community. They are a professional group. Their aims, however, affect the problems and needs of other social divisions in the community; that is, they train the young men and women who are to become the motive force in other social divisions such as law, medicine, engineering, and business. If the teachers are isolated from these other groups and especially from the groups into which their respective students are to go, if they do not exercise free unobstructed coöperation with these groups in the full swing of life, if they permit themselves to be hemmed round to the exclusion of all but their own specialization, then their work is bound to degenerate into impractical and fussy hastening to and fro. If the teacher's work is to be trusted, he must perceive in the active life about him outside of the University the problems which his fellows are endeavoring to solve. From this relationship he brings to his students then, wider application of his specialty, and fresh realization as to the worth of his instruction, both of which are an effective stimulus to his students. . . .

"To summarize briefly, free unobstructed contact between the University and the community makes for good teaching which, in turn, makes for the welfare of the community. Teachers should avail themselves of every reasonable opportunity to grasp the problems and needs of the life about them, especially that life into which their respective students expect to go. On the other hand, no work outside of service to the University should be carried on by teachers if that work interferes with the thorough and effective performance of their duties."

THE OPPORTUNITY IN ENGINEERING EDUCATION.

BY WILLIAM E. BULLOCK,

Assistant Secretary, The American Society of Mechanical Engineers.

Practical engineering today consists not so much in finding the true mathematical solution to some problem of utilization of the forces of Nature—the solution can usually be purchased for so many dollars—but more in selling to the people who pay for engineering something that they will buy, and in inventing a sometimes complex series of arguments and shibboleths for making the sale.

This is so plainly the case with most civil engineering as to need no elucidation. No less an engineer than Brigadier-General Guy E. Tripp, writing on the subject of water power development, says that from now on every hydraulic generating station should be designed with reference to a great interstate system of distribution. Engineering science has prepared the way for such a system. It has studied every source of power and every center of power distribution in America; and since it knows or can accurately estimate every factor involved, it has devised means for supplying all of the power needed for fifty years to come. The plans are complete, but a leader is needed to put them into execution. This man need not necessarily be an engineer, for the only remaining problems to be solved are political, social and economic; the technical, and scientific work is all done. However, if he were an engineer, as all engineers hope that he might be, his need for his knowledge of the principles of hydraulics and of electricity will be only secondary.

Other examples may be cited to illustrate the point, as it is interesting and impressive, and also useful to those who have in hand the training of the engineer of the future.

The bridging of the Delaware River over forty years

after the building of the Brooklyn Bridge, an exactly similar structure, is not a circumstance caused by any condition that the civil engineers did not know before how to figure the larger span. Every engineer would laugh at such an implication. But in the forty years how many civil engineers in the Nation tried for the leadership waiting in Pennsylvania and New Jersey?

Additional vehicular tunnels connecting New York and New Jersey under the Hudson River are now being "sold" to private capitalists, the chief talking point being the public tunnel now being constructed. However, the tunnel to Staten Island has not yet been sold, and the most conspicuous engineers attempting the leadership required to bring Manhattan nearer Staten Island is T. Kennard Thompson, who has been trying twenty-five years to sell the idea of lengthening Manhattan by filling in five miles of the bay south of the Battery.

Engineering leadership seems to be woefully lacking in New York City, which is a great pity for there are so many engineering problems unsolved there.

But leaving civil engineering for a minute, since most of its development depends on political as well as economic considerations, and examine whether it is true in other lines, that the principal requirement today is not for technical design but rather for opportunity to get designs into production, what do we find?

Of the thousand patents granted every week, about a thousand are modifications of existing designs. None are really basic discoveries of really new principles—these only occur once in a few years, not once a week. Of these thousand patents, about seven hundred are issued to independent, in the sense of unconnected, inventors, and probably not more than ten a week ever get into manufacture. Any intelligent and educated engineer could himself produce the whole seven hundred, were there any necessity for him to do so. This seems a sweeping statement, but would you

not insult a good engineer if you put a problem up to him and he could not solve it? But the point is that in this field, ability to design has become secondary to leadership to overcome the economic, and sometimes social, resistance to getting new designs into production.

The radio field offers an up-to-date example of what practical engineering today really is. The pioneers in this art, the real engineers, were held up on their engineering until it was seen fit to introduce broadcasting to the public. Now that it is introduced, the whole thing is held up again through lack of proper legislation. However much radio and electrical engineers specialize on the design of new circuits, political, social and economic problems, all three here, prevent radio from being developed faster than a certain pace. At some points in the game, perhaps sometimes extending over some months, the need for technical progress amounts to nil. Meanwhile, of course, all the trained electrical engineers have to live.

Education for practical engineering, if the engineer aspires to become something more than a higher type of artisan, has come to a different thing from what it was at the time of the passage of the Morrill Act. The function of the engineer was then to deal scientifically with purely mechanical problems, and this conception was then sufficient.

But through the years the engineering profession has become dissatisfied with this function, and perhaps justly so. Since the War, the profession has become even more than dissatisfied; it has become restless. The leaders in the profession are calling for revolt, calling for the engineers to rally and take the place in the community that rightfully belongs to them. The rank and file of the engineers do not seem to want to revolt—they seem to be content to remain higher type artisans. They think engineering education as at present administered is sufficient, and that if you cut off all the frills and stick to the basic principles, the engineer so produced can take care of himself. But the leaders have got

some of the educators stirred up, into believing that engineering education still produces too narrow specialists, higher type artisans only, with no standing in the community. Committees are appointed, one committee to make a study covering ten years, and something is going on.

Steiner, in "The Threefold Commonwealth," pictures every individual as having to live a threefold life—first, his *economic* life, his material needs and adjustments in the world around him; second, his *public* life, whatever exists in the body social because of men's relations with one another; and third, his *spiritual* life, everything that plays a part on the ground of his natural endowments, both spiritual and physical, and gives him individuality.

Engineering education, in the strictest sense of the word engineering, technical education, is at basis spiritual. It has to do with a man's individuality, his mental equipment. It is something which is supposed to fit him for, but not necessarily educate him in, his public life, so that in turn he may be allowed to live his economic life.

Granted that the public life of the engineer, and also his economic life, is now very much different from what it used to be, but so are the corresponding lives of every other citizen. And, moreover, they are both constantly changing in a great complexity. They are not founded on such constant relations as Ohm's Law.

Immediately, therefore, one question for engineering education is whether its aim is or is not to make an engineer an educated economic, public and spiritual being, all three in a community of specialized people like doctors, lawyers, bankers, and workmen. How much do we expect of engineering education? If we could get it, to what extent will the other specialists let us use it? If the present plans for water power development need only a leader, the technical problems having been solved and the only outstanding ones being primarily political, must we suppose that legal education does not see the opportunity for producing that leader?

We see therefore that engineering education is in an environment of educations, each aspiring to produce the leaders required to solve the political, social and economic problems of life and progress.

Therefore it seems that if engineers may aspire to become leaders, and they have every right to, for their spiritual, and public capacities, as well as their economic right to exist, are certainly equal to those of any other trained specialist, then engineering education should be designed to produce such leaders, and every engineering student should be regarded as a potential leader.

Engineering itself must be regarded as a twofold thing, just as it is now being regarded by the leaders in the profession. It is now being defined as utilizing the forces of Nature, *for the benefit of mankind*, which makes it twofold.

Lastly, engineering education must be treated as a twofold thing, and the student early made aware of this duplexity. Knowledge and experience in engineering design must be regarded as developing the spiritual capacity of the individual and giving that ideal of creative work which characterizes the engineer.

But the other half of engineering education must deal with the public and economic life which the student must soon enter. It is this half which imparts the ideal of service, which characterizes men of all professions. It is from this half, rather than from the other that the engineer must rise to leadership, must rise in competition with men from other professions.

Engineering schools have found it comparatively easy to achieve success in the first half. Success in the second is a little more difficult, but it offers much the greater opportunity.

COMPULSORY EDUCATION.

BY LEE N. GULICK,

Assistant Professor of Mechanical Constructive Practice, University of Pennsylvania.

Almost daily it is possible for one to pick up a newspaper or technical journal and to find therein some reference to the question of compulsory education, intimating that in our desire for education we are overlooking the fact that not every one can take instruction; and in our attempt to educate indiscriminately we are doing more harm than good.

It is well to provide facilities in order that equal educational opportunities may be had by all peoples. However, to drive them beyond the point of their capacities (which period is plainly indicated by their evident lack of interest in study and their desire to go to work) is neither doing them any good nor serving the best interest of the State.

The comments referred to are like the rumblings we hear before a storm. It is the gradual awakening of public thought and interest in a subject that calls for an ever increasing burden of taxation, to maintain a business in which there seems to be no limit or point of maximum results.

If the large majority of our people have not the capacity to profit by the elementary school education now provided by the country, as shown by all investigations, why burden our children through compulsory education with what we admit is beyond their capacities and hamstring communities with unnecessary taxes?

That the great majority of our people can not take instruction can be proven by anyone who cares to make the test upon those with whom they come in contact in business, by noting whether better results are secured through verbal and written instructions or through observation and imitation.

The test may best be conducted through some project that admits of solution under the conditions suggested. First give verbal instruction, and if failure results, perform the task and have the observer repeat. Repeat the verbal and objective instruction if necessary.

One of the great difficulties met with in the higher schools is lack of capacity and accounts for the large falling off in numbers as the work progresses.

Some day either an educational organization or some educator who is of such prominence that what he says will arrest attention from the public as well as educators, will tell people of their limitations. Then will he turn the thoughts of all toward securing a sane balance in education.

THE ENGLISH DEPARTMENT.

Of course there is to be an English conference in connection with the annual meeting of the Society at Cornell in June. Last year's conference at Urbana succeeded so well in bringing together a representative number of both English teachers and teachers of technical subjects interested in the problem of an adequate English training for our engineering students, that before we adjourned, we had provided by unanimous action that a similar conference be planned for the Cornell meeting. If there were nothing more to be gained from such a conference than the opportunity afforded us English teachers to become acquainted with each other and to profit by the exchange of experiences, the conference would be well worth while. But if, as was the case at Urbana, fully one half of those present and actually engaged in the discussions are deans and heads of technical departments, the possibility of developing a definite plan of coöperation between the English instructors and those in technical subjects, and of coördinating our English instruction more perfectly with the rest of the curriculum seems quite inspiring.

The English Committee, therefore, announces two conferences to be held in connection with the meeting of the S. P. E. E. at Cornell, the exact time and place to be announced later in the official program. To these conferences the Committee cordially invites all teachers of English to engineering students and all teachers of technical subjects and all deans or administrative officers interested in the problem of providing more adequate training in English for our students. The Committee urges all deans of engineering schools to see to it that, wherever possible some representative of their faculty be present at our conference.

The conference last June set down in its report the following as one of its ideals:

"Our method of procedure must be to establish at all possible points the closest possible inter-relationship between the instruction in English and that in professional subjects."

After a year of effort to work out that ideal in practice may we not hope that the approaching conference may succeed at least in making a canvass of the experience we have had in the various schools represented in establishing points of contact between English and the work in the professional courses. What has been done and how satisfactory have been the results? Then further some definite plan should, it seems to me, be worked out by the conference for establishing this close inter-relationship in a more practical way than has been heretofore attempted. The keynote of these two conferences will, therefore, be "Coördination,"—the more perfect coördination of the instruction in English with that in the technical subjects.

Such a conference coming as it does only once a year is too good an opportunity to be lost for the discussion of a multitude of practical problems that arise in our work as English teachers. I would suggest, therefore, that you send me at once all such questions as you would personally like to have discussed at our round-table at Cornell. The Committee also solicits now in advance suggestions and criticisms which will in any way help to make the English conference of real service to the cause of engineering education. Address, J. Raleigh Nelson, 927 Forest Ave., Ann Arbor, Michigan.

REPORT OF COMMITTEE NO. 8—ADMISSIONS.

With the rapid coming of the Junior High School, there is a change in high-school organization which makes advisable the re-statement of college entrance requirements. This arises from the fact that the Junior High School covers the period of seventh, eighth and ninth grades. The student who has advanced from it is left with only the three years of tenth, eleventh and twelfth grades in the school specifically called the "Senior High School." Beside this movement, there is also a tendency toward the establishment of more Junior Colleges, and the problem of admission to engineering colleges from these will soon require attention, where it has not already been solved.

In the matter of the Junior and Senior High Schools we quote the following statements from the North Central Association of Colleges and Secondary Schools:

RECOMMENDATIONS AS TO ENTRANCE REQUIREMENTS.

1. That the colleges, in order to encourage the reorganization of the seventh, eighth, and ninth grades upon junior high school basis be requested to provide an alternate system of entrance requirements to include not more than twelve units (24 points) of senior high school work, said units to be completed in the tenth, eleventh and twelfth grades.

2. That the following distribution of units for entrance to North Central Colleges and Universities be considered in the re-statement of entrance requirements:

A major of 3 units (6 points)
Two minors of 2 units each (4 units) (8 points)
Electives 5 units (10 points)
Total 12 units (24 points)

(a) English to be offered either as a major or minor.
(b) At least 9 of the 12 units to be in academic subjects.

(c) The two minors may be specified for entrance to the various colleges of any university.

The question immediately arises as to how the engineering colleges shall prepare their new statements of admission requirements. A proposed arrangement is appended. It is presented without argument or discussion further than to note that it may be presumed that English will become a requirement of the ninth grade and therefore by appearing in the Senior High School requirements as "at least a minor," there will be offered a minimum of 3 units (6 points).

The committee will be glad to receive comments upon this proposition.

Students bringing credentials from three-year Senior High School courses corresponding to tenth, eleventh and twelfth grades will be required to present 12 units (24 points) for full entrance. These should be divided so as to have at least one major of 3 units (6 points) and two minors of 2 units (4 points) each, and electives of 5 units (10 points).

(a) English must be offered, at least as a minor.
(b) Mathematics must carry through advanced Algebra and Plane Geometry.
(c) Science with laboratory must include Physics, and General Chemistry is recommended.
(d) A History-Civics-Economics minor is recommended.
(e) At least 9 of the 12 units (18 of the 24 points) must be in academic or home-study subjects.

FREDERIC BASS,
L. F. RONDINALLA,
L. L. THURSTONE,
O. J. FERGUSON, *Chairman.*

THE LECTURE METHOD IN PRACTICE.

BY H. W. BIBBER,

Massachusetts Institute of Technology.

It may be of interest in connection with Professor Veazey's paper in the December Bulletin to mention that the lecture system as he describes it has long been used in the most prominent French school preparing engineers for industry, the Ecole Centrale des Arts et Manufactures at Paris.

As Exchange Instructor to this institution in 1920–1921, the writer had occasion to become familiar with their methods of instruction. Dr. Kennelly, in his excellent report on the education of engineers in France published in the November *Engineering Education,* states correctly that the laboratory work is considered of secondary importance, and the principal emphasis is placed on the lecture courses.

The lecturers are specialists who in many cases come from outside the school. Thus the lecturer in mathematics for many years was Professor Appel of the Sorbonne faculty, as was also the lecturer on chemistry, Professor Urbain. The engineering courses are often given by practicing engineers, who thus bring to their students the most recent advances in the art.

The students are required to take notes in the standard size notebooks. These are reviewed every three or four weeks at the oral examinations which the students have to pass. The oral examinations are usually conducted by younger men who are assistants to the lecturer. They grade the students on a ten or fifteen minute session at the blackboard and on their notes.

Written examinations in the courses are seldom em-

ployed. Neither are textbook methods of instruction used. In certain subjects, sets of data sheets or plates of drawings are issued to students, when taking these as notes would be impossible. Of course the students are welcome to make use of whatever text they may find helpful in assisting them to grasp a subject or to get acquainted with details which the lecturer may not have had time to cover.

THE MAN AND THE JOB.

BY G. M. EATON,

Chief Mechanical Engineer, Westinghouse Electric & Manufacturing Company.

Let Y equal the burden of responsibility imposed by the job.

Let X equal the number of men competent to shoulder the load.

Write the equation of the life line.

Analyzing the limits—

When no burden of responsibility exists, anybody can fill the bill, and therefore when $Y =$ zero, $X =$ infinity.

When the burden is infinite, no man can stand the gaff, and therefore when $Y =$ infinite, $X =$ zero.

Analyzing the approaches to the limits, we see that a small increment of responsibility above zero eliminates a very great number of individuals. Each successive increment, however, eliminates a decreasing number.

We can therefore at once describe the general shape of the curve as referred to rectilinear coördinates. It is asmyptotic to both axes and is concave up. It is obviously approximated by the hyperbola with the eqation $XY =$ a constant. See Fig. 1.

For purposes of discussion, we will neglect the possible detail discrepancies between this equation and the actual and proceed as if it were fundamentally true.

Stated in words—

The product of responsibility and the number of men competent to bear it, is a constant.

Life in the abstract is a hyperbola.

Life in the living is climbing the hyperbola.

We will first study a few of the phenomena encountered

in ascending a single hyperbola, bringing out later that a third dimension is involved and that no real life exist in "Flatland."

Consider the case of a group of university graduates entering an industrial establishment as students. In the first analysis the curve covered the entire human race, but with Mr. Einstein's permission, we will change our measuring stick and the curve will at once represent the ability the employer expects to find in these men. They start at the right-hand end of the curve, but obviously their load-sustaining capacity covers a wide range. There is, therefore, an apparent discrepancy in our equation.

There was a time when it was considered up to the young man—and up to him alone—to show what stuff was in him. Today the existence of a joint responsibility is recognized. The mist must be penetrated by both the man and the establishment. The more thorough and effective the effort on both sides, the quicker will be the clearing of the atmosphere, and one head after another will appear above the fog, to start moving toward its logical position on the curve, till the group is strung out and each man moving at the speed dictated by his ability and effort. We will assume that even the least able man has made material advance.

Now take that part of the curve intercepted between the men of the highest and the lowest ability; again apply the principle of relativity, and Fig. 1, after a fashion, represents the group from a somewhat different angle. The lowest man has advanced in his actual capability to serve, but relatively he has slipped back. We have, therefore, a new slant on the adage that "A man goes up or down and cannot stand still."

Periods of depression like the one we have just experienced drive home the lesson that the opportunity to serve goes hand-in-hand in the long run with relative ability to serve.

We can often learn much from anlyzing the slope of a curve. The going at the right-hand end looks easy, with small chance to slipping. But every step up demands stick-

ing to it harder to develop the requisite adhesion, and shortly, digging-in is essential to secure sound toe holds, each successive hold requiring increased effort.

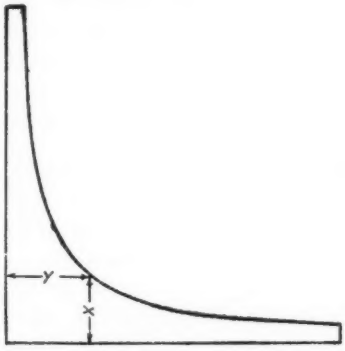

Fig. 1.

We have been analyzing what we believed to be a single plain curve, but we find on close scrutiny that we are dealing with a laminated structure, and incipient cleavage planes are found to exist. See Fig. 2. The hyperbola exists in each lamination, and the various men are beginning to segregate as directed by their several abilities and preferences. Some gravitate to salesmanship; some to engineering; etc.

After a little more time has elapsed, and as we look with a stronger glass, we find further latent cleavage as specialized leanings become defined.

Thus, we find the industrial life to be a hyperbolic prism with a detail structure built up of many laminations akin to a mica crystal. We have spoken of planes of cleavage, and our analogy to mica may profitably be pushed a bit further. Each Lamination is complete in itself, but the whole crystal is strong only as each lamination remains sound and in a state of close cohesion with its coöperating laminations. And as the lamination is to the crystal so the department is to the establishment, the establishment to the in-

dustry, and the industry to the college, and both to life in all its phases, nations and races.

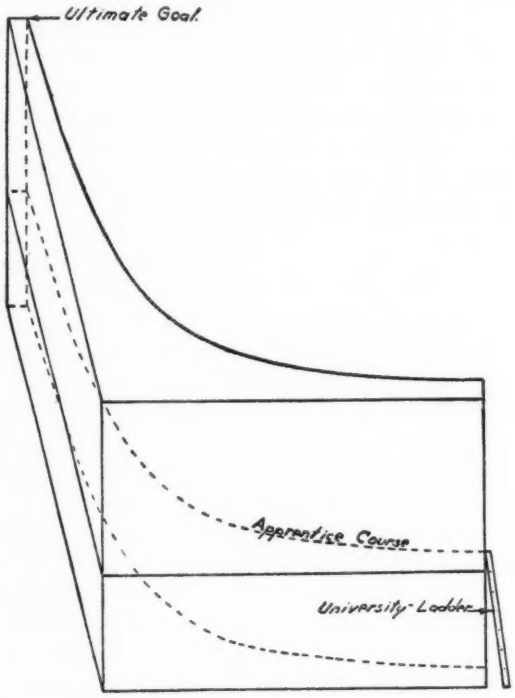

Fig. 2.

The lamination that "sluffs" off its close relation to the whole ultimately disintegrates and vanishes, leaving perhaps a gap for a while, which is healed with the lapse of time, and life goes on, and jobs go on, and men go on.

The life prism has smooth perpendicular sides. The graduate student lamination stands at a dizzy height, measured with the yard-stick of the boy who cannot afford the luxury of a university training and in a lesser degree to him who

earns his way through. The college man who early recognizes his course as a ladder that will reach to this level is fortunate, while often the man who has had to work his way finds that the very operation has served to sharpen the calks on his boots, so that they grip firmly on the steeper pitches of his chosen hyperbola.

Each individual—and we here revert to our original scale and include the human race—each individual has his own ideal structure of life. If he has been free to follow his natural bent, he sees his particular lamination at the top of the prism, and from this height he looks down with more or less toleration on what, to him, are more lowly callings. If his conception pictures more glorified planes, and he has any red blood in his veins, he will move heaven and earth to bore up his ideal, and start to climb the new heights from which with broader vision he can see and aspire to still nobler achievement.

FEDERATED AMERICAN ENGINEERING SOCIETIES.

26 JACKSON PLACE, WASHINGTON, D. C.

March 9, 1923.

From: Office of the Executive Secretary.

To: Deans of Engineering Colleges and Presidents of Universities.

Subject: Industrial Ideals.

As you doubtless know, the Federated American Engineering Societies was organized for the purpose of having an agency through which the engineering profession as such might render essential public service. This organization has been functioning for two years. A brief history of it, as well as a statement of its activities are set forth in the February–March Bulletin, a copy of which is being sent you herewith. This BULLETIN will also indicate the present membership in the Federated American Engineering Societies and will indicate, to a degree, at least, the characteristics of the personnel of its Board of Directors, namely, American Engineering Council.

The officers of the Federated Societies and the members of American Engineering Council, through conducting this work, have come to realize that engineers in the mass, have not developed to the fullest extent their sense of public responsibility and their training and education in the main have not fully prepared them to occupy a place of leadership in public affairs. In many respects the engineer is ably qualified for such leadership but the desire for such has not been inculcated. Reflection on this has led the American Engineering Council to the conviction that the technical institutions of the United States should give most serious consideration to the matter of training for, and stimulating in the mind of the young men taking engineering courses a desire for leadership in public affairs. To accomplish such training and stimulate such a desire does not necessarily mean any radical or material changes in the curriculum but it does require some change in the point of emphasis.

In accordance with the foregoing thought, American Engineering Council appointed a committee to give consideration to this matter. This committee prepared a set of resolutions relating to the training of engineers for public and industrial leadership, which were approved by the American Engineering Council at its recent meeting.

This office was instructed to place a copy of the resolution in the hands of the Presidents and Deans of Engineering of the technical institutions of the United States.

Enclosed herewith is a copy of the resolution adopted. We sincerely

hope that you and your faculty will give serious consideration to them and take such action as may be required to bring about the results so needed and desired. We would appreciate being advised as to the reaction of your faculty in regard to this matter as well as to what action was taken.

Very sincerely yours,

L. W. WALLACE,
Executive Secretary.

REPORT OF THE COMMITTEE ON INDUSTRIAL IDEALS.

The Committee on Industrial Ideals, appointed under action of the Executive Board at its meeting in Boston, September 9th, 1922, presents the following resolution:

Resolved that

The American Engineering Council by action at its meeting on January 10, 1923, desires, on behalf of the Federated American Engineering Societies, to bring to the attention of the engineering colleges throughout the country the need of pointing engineers toward leadership in public affairs.

For a century engineers have directed their energy toward the utilization of the physical forces and the materials of nature. The developments which they have brought about have created an epoch in human history. While these developments have been of inestimable benefit, and modern society could not exist without them, they have introduced many public problems and social readjustments, so closely related to the engineer's activities, that it is increasingly evident he must assume an active part in their solution.

Recognizing this growing need, the engineers of the country formed the Federated American Engineering Societies, primarily to place their knowledge and training at the public service on all public matters affecting engineering, or affected by it.

Engineering education, reflecting closely the attitude of engineers heretofore, has confined its work almost exclusively to scientific and technical training, giving little, if any attention to the social and human aspects of engineering enterprises. The American Engineering Council therefore, speaking for the engineering profession, urges upon engineering colleges an increased attention to the social aspects of engineering activities, and a broadening of their technical training, in every way possible, to develop in engineering students the spirit of, and a capacity for, active leadership, not only in industry, but in public affairs.

SECTIONS AND BRANCHES.

The **Case School branch of S. P. E. E.** held its second meeting of this year on February 1.

Professor Vose spoke on the subject, "Some Tendencies in Engineering," after which two sub-topics were discussed: "Can an Undergraduate be Given a Combined Engineering and Business Training in Four Years," by Professor Boylston, and "The Advantages or Disadvantages of Introducing Engineering Subjects into the Freshman Year," by Professor Dates.

Following the presentation of these interesting papers, a spirited discussion was held on the subjects, a number of those present taking part.

GEORGE H. BOST,
Secretary.

At a recent meeting of **Georgia Tech. Section** the following offiicers were elected:

Chairman, Floyd Field.
Secretary, John L. Daniel.

A meeting of the **Minnesota Section** of the Society was held on February 1, 1923, in Room 201, Minnesota Union.

Thirty-nine members and guests gathered for a 5:45 o'clock dinner.

Professor W. E. Brooke, President of the Section presided.

The subject for discussion was the foundation courses for engineers. Dr. Tate, of the Physics Department, made a strong plea for physics. Mr. Hartig, of the Mathematics and Mechanics Department, made a strong plea for a course of general lectures of fundamental konwledge of life and

Mr. K. Kirk, of Chemistry, very ably presented the case of foundation courses in the standpoint of Chemisty.

After the above three principal speakers, there was a general discussion in which Professors Hermann, Shepardson, Miller, Jansky, Bass, Priester, Brooke, Parcel, Robertson, Dalaker, Stewart and Dean Leland took part.

The meeting adjourned at 10:00 o'clock P.M. Before adjourning Professor Brooke announced that the next meeting of the Section would be held either late in March or early in April and the first matter of business to come up at the next meeting would be election of officers.

W. F. HOLMAN,
Secretary.

New England Section. *A Program at which other Sections should aim.*

PROGRAM

Saturday, April 7, at Wentworth Institute

MORNING SESSION—10:45 A.M.

Introduction.....GARDNER C. ANTHONY
Chairman, New England Section, Society for Promotion of Engineering Education.

The History of and the Outlook for Coöperative Study of Aims and Needs of Technical Education.DUGALD C. JACKSON
Professor of Electrical Engineering, Mass. Institute of Technology and President of Boston Society of Civil Engineers.

Industrial Education in Massachusetts....ROBERT O. SMALL
Director, Division Vocational Education, Department of Education of Massachusetts.

The Advance of Education Toward Scientific Exactness
HENRY W. HOLMES
Dean, Graduate School of Education, Harvard University.

AFTERNOON SESSION—2:00 P.M.

The Changing Requirements of Industry...CHARLES R. GOW
President, Associated Industries.

The New Responsibilities of Education DR. CHARLES W. ELIOT
President Emeritus, Harvard University.

A Viewpoint of Industry and of Engineering Education
EVERETT MORSS
President, Simplex Wire and Cable Co., and Member, Corporation of Mass. Institute of Technology.

The Use of Occupational Specifications as a Basis for Educational Plans.....JOHN A. RANDALL
President, Rochester Mechanics Institute.

A Discussion by.....ARTHUR L. WILLISTON
Principal, Wentworth Institute.

A Summation by.....DR. CHARLES R. MANN
Director, American Council on Education, Washington, D. C.

The New England Branch of the Society for the Promotion of Engineering Education held its Annual Spring Banquet in the Alumni Room of Wentworth Institute at 6:30 P.M.

EVENING SESSION—7:45 P.M.

Address.....GEORGE W. COLEMAN
President, Babson Institute.

The Challenge of Industry.....CHARLES F. SCOTT
President, Society for Promotion of Engineering Education.

Some Practical Suggestions.....GEORGE F. SWAIN
Professor of Civil Engineering, Harvard University.

The Need of An Increasing Coöperation Between Industry and Education.....PAYSON SMITH
Commissioner of Education for Massachusetts.

A series of discussions were conducted by Professor J. C. Chapman of the Department of Education under the auspices of the **Yale Branch** of the Society on the general subject of "Procedure in College Teaching."

The following topics were discussed:

The Mechanism of the Learner
The Teacher as a Stimulator of these Mechanisms
Modes of Testing Efficiency of Instruction
The Classification of Students

These meetings were held at the Department of Education, 28 Hillhouse Avenue, Tuesdays at 4:00 o'clock on the following dates: February 13, 20, March 6, 13, 20, 27. Twenty men enrolled.

COLLEGE NOTES.

University of Colorado.—During the spring vacation, the Electrical Standardizing Laboratory under the supervision of the Extension Division and direction of Professor C. M. McCormick of the Electrical Engineering Department, gave a course in meters and meter testing to the representatives of public utilities companies in this section. Thirteen utilities were represented from Colorado and Wyoming.

University of Illinois.—Advanced courses in mechanics and Mechanical Engineering will be offered in the coming Summer Session of the University of Illinois beginning June 18, 1923. It is the thought that these courses may prove attractive to some of the younger members of the instructional staffs of engineering colleges of the country and to others who wish to spend further time in study.

The offerings this summer are again in Mechanics and Mechanical Engineering. An outline of the courses will be sent upon request. Those who may consider registering in this summer work will doubtless wish to know something of the men who are to give the courses. For their benefit, a brief statement about those who will give the instruction will be mailed.

Requests for the Summer Session Bulletin, which gives in-

formation concerning admission, fees, etc., should be made direct to the Director of the Summer Session.

We are giving these courses in the hope that the offerings will stimulate graduate work.

Iowa State College.—A number of research scholarships have been established for the Summer Session of 1923. These are available to students who wish to pursue graduate study in Highway Engineering and who are qualified to assist in the regular research work of the Engineering Experiment Station.

The scholarships carry a stipend of $175.00 for the 12 weeks of the summer session and the recipients will be able to complete 18 graduate credits during the summer session. They will devote half time to graduate study and half to research work.

Applications for the scholarships may be filed with the Dean of the Graduate College, Ames, Iowa.

Michigan College of Mines.—The Board of Control and the Faculty announce the addition to the curriculum of a full year course in General Economics, to replace the course now being given in the Department of Metallurgy.

The new course will be required of all candidates for a degree, and will begin in the fall term of 1923. It will be given by Professor J. B. Cunningham, head of the Department of Metallurgy.

University of Washington.—The annual spring excursion of the College of Mines, was made this year from March 21 to 27th to the property of the Britannia Mining and Smelting Co., on Howe Sound, British Columbia. The party of thirty under the direction of Dean Milnor Roberts and Professor Joseph Daniels divided its time between the Britannia mine and the new concentrating plant of five thousand tons capacity which recently went into operation. Mr. C. P.

Browning, general manager, accompanied the party during its stay.

BOOK REVIEWS.

Design of Machine Elements. J. C. MEASE, G. F. NORDENHOLT. McGraw-Hill Book Co., 6 x 9, 237 pp., 101 figures. Price $2.50.

This book is a rather brief treatise on machine design and is intended to give an elementary course without presenting difficult problems. Combined stresses are omitted entirely for this reason. The theoretical basis of empirical formulas is given when possible, but empirical formulas are frequently avoided. The authors' claim for this omission is to induce the student to reason out his problems by applying fundamentals.

The following headings cover the subject matter: definitions and simple stresses, moments and moments of inertia, materials and fundamental considerations, bolts, nuts, screw fastenings, determining bolt diameters, cylinders and riveted fastenings, keys shafts, belt transmission, gear tooth profiles, spur gears, bevel gears, worm and worm wheel, belts and pullies, bearings, connecting rods, flywheels, helical springs, friction.

W. F. W.

Descriptive Geometry. LAWRENCE E. CUTLER, Associate Professor of Mechanical Engineering, Stanford University. McGraw-Hill Book Co.

A textbook, from the author's viewpoint, best serving the needs of Engineering practice; laying special emphasis on the method of projections, almost to the exclusion of the method of rotation.

It is a question whether in point of mental discipline there is anything to choose between the two methods. Also it is doubtful whether in all cases from the point of utility the

method of choosing projection planes is incomparably superior to the method of rotation.

The author has reduced the theory to form simple principles which are applied in the solution of the many elementary problems.

Two chapters are devoted to problems for home and drafting room study including many practical problems in engineering, mining and geology work.

R. F. E.